SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Socioeconomic Impact Assessment for Proposed Amended Rule 1469 – Hexavalent Chromium Emissions from Chromium Electroplating and Chromic Acid Anodizing Operations

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EXECUTIVE SUMMARY

A socioeconomic analysis was conducted to assess the potential impacts of Proposed Amended Rule (PAR) 1469 on the four-county region of Los Angeles, Orange, Riverside and San Bernardino. A summary of the analysis and findings is presented below.

Elements of Proposed Amendments	The purpose of PAR 1469 is to protect public health by minimizing public exposure to hexavalent chromium emissions from chromium electroplating and chromic acid anodizing operations. PAR 1469 would require: 1) installation of air pollution control equipment on hexavalent chromium containing tanks that emit or have the potential to emit hexavalent chromium that are currently not regulated; 2) periodic source testing and parametric monitoring of air pollution control equipment; 3) building enclosures with openings that do not exceed three and a half percent of the building envelope; 4) conditional requirements for use of a Permanent Total Enclosures (PTE); 5) implementation of Best Management Practices (BMP) for all hexavalent chromium containing operations; 6) prohibiting the use of chemical fume suppressants that contain PFOS; and 7) re-certification of non-PFOS chemical fume suppressants due to potential toxicity concerns via an enhanced certification process conducted by SCAQMD and the California Air Resources Board (CARB).
Affected Facilities and Industries	SCAQMD staff has identified 115 facilities that either conduct decorative or hard chromium electroplating or chromic acid anodizing operations within SCAQMD's jurisdiction. 80 of the 115 affected facilities are located in Los Angeles County, 30 in Orange County, one in Riverside, and the remaining four in San Bernardino County. The majority of the potentially affected industries are in the manufacturing sector (NAICS 332), consistent with electroplating, plating, polishing, anodizing, and coloring facilities. This universe of facilities and tanks were obtained via SCAQMD's recent surveys and equipment permitting database. Of the 115 affected facilities: • 47 facilities conduct decorative hexavalent chromium plating, • 31 facilities conduct hard hexavalent chromium plating, • 30 facilities conduct chromic acid anodizing, • four facilities conduct trivalent chromium plating only, • three facilities conduct both chromic acid anodizing and hard hexavalent chromium plating. Data on employment and revenue were available for 104 of the 115 affected facilities. Based on this data, the total annual revenue for affected facilities is nearly $1 billion dollars and the total number of employees directly employed by affected facilities is approximately 5,300 in 2017.
Assumptions of Analysis	Many of the costs estimated in this analysis are dependent on site-specific factors and on business decisions made by facilities subject to PAR 1469. Each facility will decide how to best to comply with the rule requirements

	and each facility will likely use a lower-cost option, if available. For this reason, two cost scenarios are provided in this analysis. A high cost scenario, which represents the highest expected cost of compliance with the requirements of PAR 1469, and a low cost scenario, which represents the costs associated with a more likely scenario. Based on the type of operations performed by the each facility, 13 categories were established based on the types of facilities (hard chromium plating, decorative chromium plating, chromic acid anodizing, multiple plating or anodizing, and trivalent) and size of the facility (small, medium, large, and other where ampere-hours could not be confirmed). **High Cost Scenario** The main requirements of PAR 1469 that have major cost impacts include the installation, operation, and maintenance of Air Pollution Control (APC) systems using High Efficiency Particulate Arrestor (HEPA) filters (point-source controls on existing and new tanks), initial source tests and screening tests, implementation of Best Management Practices, construction of Permanent Total Enclosures, and building modifications. Under the high cost scenario, it is assumed that a total of 103 Tier III Tanks located at 55 facilities will require APC systems, with one APC system assumed for each tank. PAR 1469 includes a provision that will require facilities to install air pollution controls, chemical fume suppressants cannot be recertified. As a result, in addition to the new APC systems for Tier III Tanks, the high cost scenario also includes cost estimates for adding APC systems for existing tanks where the only control technique that are currently used are chemical fume suppressants. Beyond the 103 Tier III Tank facilities identified, there are 27 facilities with chromium electroplating and/or anodizing tanks that use chemical fume suppressants as their only form of control. Out of the 27 facilities using chemical fume suppressant controlled tanks, 12 facilities have both electroplating/anodizing tanks and Tier III Tanks. The remaining 15 facilities only have electroplating/anodizing tanks and represent some of the smallest facilities (based on revenue) in the PAR 1469 universe. Under the high cost scenario, it is assumed that a total of 130 (103+27) Tier III Tanks located at 70 facilities will require APC systems for each tank (130 total). This includes 55 facilities with existing Tier III Tanks plus 15 facilities with chemical fume suppressant controlled tanks that would require APC systems if no certified chemical fume suppressants are available by 2021. **Low Cost Scenario** Under the low cost scenario, it is assumed that a total of 103 tanks located at 55 facilities will require APC systems. Under this scenario it is assumed that a re-certified chemical fume suppressant will be available by July 1, 2021, and that the 27 facilities currently using chemical fume suppressants as their

only form of control will be able to continue using a re-certified chemical fume suppressant rather than installing APC systems. In addition, the low cost scenario assumes that where possible, facilities with higher ventilation needs will be able to vent more than one Tier III Tank into a single APC system and as a result, only 64 APC systems would be installed at 55 facilities. Below is a table summarizing the assumptions used in the high and low cost scenarios.

High Cost Scenario		**Low Cost Scenario**	
# of Facilities	70	# of Facilities	55
# of Tier III Tanks	130	# of Tier III Tanks	103
# of APCs	130	# of APCs	64

To estimate capital costs of APC systems, several quotes obtained from vendors indicate that unit costs ($/cfm) decrease as APC systems increase in size. Unit costs used in this analysis are shown below:

System Size (cfm)	**Unit Cost**
Up to 5,000	$23/cfm
5,001 to 10,000	$17/cfm
10,001 to 20,000	$14/cfm

It is anticipated that facilities would combine tanks to utilize a larger APC system instead of installing multiple APC systems, resulting in a lower overall cost.

Compliance Costs

The total average (2019 to 2035) annual compliance cost for PAR 1469 affected facilities was estimated to range from $2.65 million (low cost scenario) to $4.26 million (high cost scenario) per year, depending on the real interest rate assumed (1%-4%).

The majority of the PAR 1469 compliance costs are capital, installation, and operating and maintenance (O&M) costs of APC systems. The annualized costs are estimated at $1.97 million (74%) for the low cost scenario, and $3.33 million (78%) for high cost scenario, respectively. Initial source tests and recurring screening tests are the next largest cost categories with about $0.4 million (15%) for the low cost scenario and $0.58 million (14%) for the high cost scenario, annually.

Annualized Compliance Costs (Capital Cost, Installation, O&M), All Facilities Combined		
	High Cost Scenario	**Low Cost Scenario**
New APC for Existing Tier III Tank	$738,000	$463,000
New APC for Existing Electrolytic Tank Controlled by CFS	$209,000	$0

Operating & Maintenance	$2,010,000	$1,168,000
Electrical Costs of Operating APC	$368,000	$338,000
Annualized Total	**$3,325,000**	**$1,969,000**

The total cost of installing the APC systems are estimated at $6.5 to $11.3 million, for low cost and high cost scenarios, respectively. The total average annual cost of installing the APCs are estimated at $0.46 to $0.97 million over 15 years, depending on the real interest rate assumed (1% for the low cost scenario) and (4% for the high cost scenario), respectively.

The current cost of a conventional source test consisting of three individual collection runs is estimated at $18,000. An emissions screening test, which is required every five to seven years consists of a single collection run and is estimated to cost $14,000.

It was assumed that only two facilities may trigger the requirement for installation of a Permanent Total Enclosure. The estimated total cost of the two Permanent Total Enclosures is $184,000 for the low cost scenario, and $340,000 for the high cost scenario. The low cost scenario assumes 6 air changes per hour, while the high cost scenario assumes 15 air changes per hour. Costs by vary by ventilation blower specifications and electrical operating costs.

The majority of the annual compliance costs ($2.65 million or 58%) is estimated to be incurred by affected facilities that belong to categories of Anodizing (Small), Anodizing (Medium), and Anodizing (Other). The majority of the annual compliance costs ($2.23 million or 84% for low cost scenario and $3.59 million or 84% for the high cost scenario) is estimated to be incurred by the sector of fabricated metal manufacturing where most of the electroplating, plating, polishing, anodizing, and coloring facilities belong.

Facility-Based Impact Analysis	A facility-based impact analysis was conducted at the request of stakeholders and is consistent with recommendations for assessment of small business impacts in a 2017 report prepared for the SCAQMD by Industrial Economics, Incorporated, "Models, Methods, and Data for Estimating Small Scale and Small Business Impacts." This analysis estimates the annual cost at a facility level scale and includes sales data for individual facilities. The average cost estimates for affected facilities range from $22,000 to $36,000. Revenue data indicates an average annual revenue for all affected facilities of $9.3 million, with a range of $40,000 to $168 million. The analysis indicates an average cost impact of 1.8% to 3.3% of revenue for all affected facilities. The facility category which bears the greatest impact is small decorative plating facilities, or Decorative (Small), which has a range of average impacts of 3.4% to 7.4% of revenue. Many of these facilities could be impacted by PAR 1469 if chemical fume suppressants are not re-certified and are required to install add-on pollution controls. Recognizing this potential financial impact to these smaller facilities, the adoption Resolution for PAR 1469 will include a commitment that staff will seek funding to help offset the cost of add-on pollution controls if non-PFOS chemical fume suppressants cannot be recertified.
Jobs and Other Socioeconomic Impacts	PAR 1469 is expected to result in approximately 37 to 63 to jobs forgone annually, on average, between 2019 and 2035 using the low and high cost scenarios are assumed, respectively. The projected jobs loss impacts represent about 0.001% of the total employment in the four-county region. The manufacturing sector (NAICS 31-33), which is projected to bear all estimated total compliance costs would have about 2 to 12 jobs forgone on average annually. The remainder of the projected reduction in employment would be across all major sectors of the economy from secondary and induced impacts of PAR 1469.
Competitiveness	It is projected that the manufacturing sector, where most of the affected facilities belong, would experience a rise in its relative cost of services by 0.0013% and 0.0022% and a rise in its delivered price by 0.0008% and 0.0012% by 2025 for the low and high cost scenarios, respectively. While these changes are relatively small, it should be noted that the delivered price change is a change in the index of all prices in the manufacturing sector. Delivered prices that a facility may charge for specific goods or services may increase at a greater rate than this, allowing incurred costs to be passed onto downstream industries and end-users.

INTRODUCTION

The proposed amendments to Rule 1469 are designed to reduce emissions from point sources that were previously not known to be significant sources of hexavalent chromium and establish additional provisions to minimize the release of fugitive hexavalent chromium emissions from chromium electroplating and chromic acid anodizing operations.

In an effort to minimize the public's exposure to hexavalent chromium, PAR 1469 would require: 1) air pollution control equipment to be installed on hexavalent chromium-containing tanks that emit or have the potential to emit hexavalent chromium; 2) conducting periodic source testing and parametric monitoring of air pollution control equipment; 3) building enclosures to meet a limit of 3.5% openings of the building envelope, which includes the area of the walls of the enclosure, the floor and the horizontal projection of the roof; 4) triggered requirements for PTE; 5) implementing BMPs for all hexavalent chromium containing operations; 6) prohibiting the use of chemical fume suppressants that contain PFOS; and 7) re-certification of non-PFOS chemical fume suppressants via an enhanced certification process conducted by SCAQMD and the CARB due to potential toxicity concerns.

LEGISLATIVE MANDATES

The socioeconomic assessments at SCAQMD have evolved over time to reflect the benefits and costs of regulations. The legal mandates directly related to the assessment of the PAR 1469 include the SCAQMD Governing Board resolutions and sections of the California Health & Safety Code (H&SC) are legal mandates that directly relate to the assessment of PAR 1469.

SCAQMD Governing Board Resolutions

On March 17, 1989 the SCAQMD Governing Board adopted a resolution that calls for an economic analysis of regulatory impacts that includes the following elements:

- Affected industries;
- Range of probable costs;
- Cost effectiveness of control alternatives; and
- Public health benefits

Health & Safety Code Requirements

The state legislature adopted legislation that reinforces and expands on the Governing Board resolutions for socioeconomic impact assessments. H&SC Section 40440.8(a) requires that a socioeconomic analysis be prepared for any proposed rule or rule amendment that "will significantly affect air quality or emissions limitations." Per H&SC Section 40440.8(b), the scope of the analysis should include:

- Type of affected industries;
- Impact on employment and the economy of the four-county region;

- Range of probable costs, including those to industries;
- Emission reduction potential;
- Necessity of adopting, amending or repealing the rule in order to attain state and federal ambient air quality standards; and
- Availability and cost effectiveness of alternatives to the rule

Additionally, SCAQMD is required to actively consider the socioeconomic impacts of regulations and make a good faith effort to minimize adverse socioeconomic impacts. H&SC Section 40728.5, requires SCAQMD to:

- Examine the type of industries affected, including small businesses; and
- Consider socioeconomic impacts in rule adoption

Finally, H&SC Section 40920.6, requires that incremental cost effectiveness be performed for a proposed rule or rule amendment that imposes Best Available Retrofit Control Technology or "all feasible measures" requirements relating to ozone, carbon monoxide (CO), oxides of sulfur (SOx), oxides of nitrogen (NOx), and their precursors. This statute does not apply to PAR 1469; moreover, cost effectiveness in terms of dollars per ton is not meaningful for air toxic regulations, since many other factors besides the amount of pollution affect the health risk such as the potency of an air toxic and the location of receptors.

AFFECTED INDUSTRIES

PAR 1469 will affect chromium electroplating and chromic acid anodizing facilities. Based on SCAQMD permitted data, internet searches, and lists of potential Rule 1469 facilities provided by industry representatives, SCAQMD staff called facility operators inquiring about their operations. SCAQMD staff visited some affected facilities if there was sufficient information indicating the facility could potentially be subject to proposed amendments of Rule 1469.

SCAQMD staff identified 115 facilities that either conduct decorative or hard chromium electroplating or chromic acid anodizing operations within SCAQMD's jurisdiction. 80 of the 115 affected facilities are located in Los Angeles County, 30 in Orange County, one in Riverside, and the remaining four in San Bernardino County.

Of the 115 affected facilities, 47 facilities conduct decorative hexavalent chromium plating, 31 facilities conduct hard hexavalent chromium plating, and 30 facilities conduct chromic acid anodizing. Four facilities conduct trivalent chromium plating only, and three facilities conduct both chromic acid anodizing and hard hexavalent chromium plating.

The majority of the potentially affected industries are in the manufacturing sector (NAICS 332), where most of the electroplating, plating, polishing, anodizing, and coloring facilities belong. Table 1 lists the type of manufacturing at affected facilities, and for each type, the facilities' industry classification, and the number of such facilities.

Table 1:
Potentially Affected Facilities by Industry

Industry	NAICS	Number of Facilities
Fabricated Metal Manufacturing	**332**	**93**
Metal Crown, Closure, and Other Metal Stamping (except Automotive)	332119	1
Saw Blade and Handtool Manufacturing	332216	1
Machine Shops	332710	3
Bolt, Nut, Screw, Rivet, and Washer Manufacturing	332722	2
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	332812	2
Electroplating, Plating, Polishing, Anodizing, and Coloring	332813	82
Plumbing Fixture Fitting and Trim Manufacturing	332913	2
Other Manufacturing	**333-337**	**12**
Other Industrial Machinery Manufacturing	333249	1
Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	333514	1
Cutting Tool and Machine Tool Accessory Manufacturing	333515	1
Other Measuring and Controlling Device Manufacturing	334519	2
Motor and Generator Manufacturing	335312	1
Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	336310	1
Other Motor Vehicle Parts Manufacturing	336390	1
Aircraft Manufacturing	336411	1
Other Aircraft Parts and Auxiliary Equipment Manufacturing	336413	2
Showcase, Partition, Shelving, and Locker Manufacturing	337215	1
Wholesale and Retail Trade	**42, 44**	**2**
Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers	423860	1
Motorcycle, ATV, and All Other Motor Vehicle Dealers	441228	1
Professional, Scientific, and Technical and Other Services	**54, 56**	**5**
All Other Professional, Scientific, and Technical Services	541990	1
All Other Support Services	561990	4
Repair and Maintenance	**811**	**3**
Automotive Body, Paint, and Interior Repair and Maintenance	811121	1
Other Electronic and Precision Equipment Repair and Maintenance	811219	1
Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	811310	1
Total		**115**

Small Businesses

SCAQMD defines a "small business" in Rule 102, for purposes of fees, as one which employs 10 or fewer persons and which earns less than $500,000 in gross annual receipts. SCAQMD also defines "small business" for the purpose of qualifying for access to services from SCAQMD's Small Business Assistance Office as a business with an annual receipt of $5 million or less, or with 100 or fewer employees. In addition to SCAQMD's definition of a small business, the federal Clean Air Act Amendments (CAAA) of 1990 and the federal Small Business Administration (SBA) also provide definitions of a small business.

The CAAA classifies a business as a "small business stationary source" if it: (1) employs 100 or fewer employees, (2) does not emit more than 10 tons per year of either VOC or NOx, and (3) is a small business as defined by SBA. The SBA definitions of small businesses vary by six-digit North American Industrial Classification System (NAICS) codes. In general terms, a small business must have no more than 500 employees for most manufacturing industries, and no more than $7 million in average annual receipts for most nonmanufacturing industries.[1] A business in the industry of electroplating, plating, polishing, anodizing, and coloring (NAICS 322813) with fewer than 500 employees is considered a small business by SBA.

Out of the 115 affected facilities within SCAQMD's jurisdiction, information on sales and employees for 104 facilities were available, based on 2017 Dun and Bradstreet data.[2] Under SCAQMD's definition of small business, there are 25 small businesses affected by PAR 1469. Using the SBA definition of small business for the manufacturing sector, all of the 104 facilities are considered small businesses. Under the CAAA definition of small business, all of the 104 facilities are considered small businesses assuming that all the facilities without annual emission data emit less than 10 tons of VOC or NOx.

COMPLIANCE COSTS

For facilities subject to PAR 1469, incremental costs were estimated for the capital outlays and related expenditures—including operations and maintenance (O&M), building enclosures with openings that do not exceed three and a half percent openings of the building enclosure envelope, permanent total enclosures, initial source tests for new APC systems as well as source tests for existing APC systems and screening tests for existing electrolytic tanks, incremental costs of permit application fees, and implementation of BMPs. The capital outlays would include APC systems fitted with HEPA filters.

All the costs discussed in this section are expressed in 2017 dollars. For the purpose of projecting future compliance costs, it is assumed that these costs would remain the same in the foreseeable future, with any increase being a result of inflation. Additionally, while it is considered in this analysis that all estimated costs would be borne by the affected facilities, the compliance costs could potentially be passed on to downstream customers of electroplating and anodizing services and products.

Staff has used the following sources to estimate costs of capital, installation, operating and maintenance of APC systems, source tests, screening tests, and BMPs:

1. Vendor quotes obtained by SCAQMD staff;
2. Vendor quotes obtained by Environomics, a consultant hired by the Metal Finishing Association of Southern California (MFASC);
3. Actual costs from a recent APC system installation;
4. Plating/anodizing facility personnel discussions with vendors or engineers; and

[1] The latest SBA definition of small businesses by industry can be found at http://www.sba.gov/content/table-small-business-size-standards.
[2] Dun & Bradstreet Enterprise Database, 2017.

5. Cost estimates from the 2006 amendment to the CARB Airborne Toxic Control Measures (ACTM) for chromium electroplating. https://www.arb.ca.gov/toxics/atcm/chroatcm.pdf
6. Vendor quotes from consultants of Montrose Environmental Group, Inc. http://montrose-env.com/

Many of the costs estimated in this analysis are highly dependent on site-specific factors and on business decisions made by facilities subject to PAR 1469. For example, many facilities have more than one tank required to be controlled under the proposed requirements. It is more cost effective to control multiple tanks using one APC system, due to reduced equipment (i.e. ductwork, blower, filter housing, etc.) as well as reduced installation, permitting, and source testing costs. However, it is often not possible to control more than one tank with an APC system because tanks required to be controlled are located in different buildings or located too far apart to use one APC system. Each facility will decide how to best to comply with the proposed requirements and an assumption is that each facility will likely use the lowest-cost option.

For this reason, two cost scenarios are provided in this analysis. A high cost scenario, which represents the highest expected cost of compliance with the requirements of PAR 1469, and a low cost scenario, which represents the costs associated with a more reasonable scenario.

It is important to note that when conducting this cost analysis, every effort was made to represent costs as realistically as possible, given that many factors would ultimately dictate what price a business will pay to ensure compliance with PAR 1469 requirements.[3] The estimated cost for each line item was either represented by an industry average or a reasonable range, based on the information and data available. The procedure and assumptions for each cost scenario are discussed below. The total cost includes overall costs over 15 years for the low and high cost scenarios. The average annual compliance cost is estimated over the years 2019-2035. The average annual compliance cost of PAR 1469 is estimated to range from $2.65 million (low cost scenario) to $4.26 million (high cost scenario) per year, depending on the real interest rate assumed (1%-4%).[4] Table 2 presents total and average annual compliance costs of PAR 1469 by requirement categories.

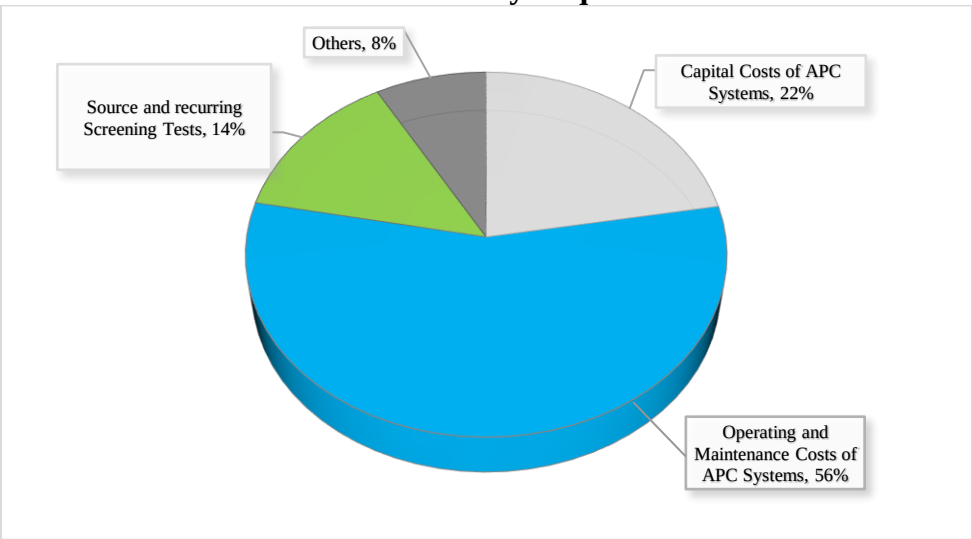
As presented in Table 2, the main requirements of PAR 1469 that have cost impacts for affected facilities would include installation of APC systems, O&M costs of APC systems, source test and screening test costs, installation of PTEs and upgrading building enclosures, and implementing BMPs.

[3] SCAQMD staff worked with Metal Finishing Association of Southern California (MFASC) consultants to develop cost assumptions for PAR 1469.

[4] In 1987, SCAQMD staff began to calculate cost-effectiveness of control measures and rules using the Discounted Cash Flow method with a discount rate of 4%. Although not formally documented, the discount rate is based on the 1987 real interest rate on 10-year Treasury Notes and Bonds, which was 3.8%. The maturity of 10 years was chosen because a typical control equipment life is 10 years; however, a longer equipment life would not have corresponded to a much higher rate-- the 1987 real interest rate on 30-year Treasury Notes and Bonds was 4.4%. Since 1987, the 4% discount rate has been used by SCAQMD staff for all cost-effectiveness calculations, including BACT analysis, for the purpose of consistency. The incremental cost reported in this assessment was thus annualized using a real interest rate of four percent as the discount rate. As a sensitivity test, a real interest rate of one percent will also be used, which is closer to the prevailing real interest rate.

The majority of PAR 1469 compliance costs are capital, installation, O&M costs of APC systems. The annual costs are estimated at $1.97 million (74%) for low cost scenario, and $3.32 million (78%) for high cost scenario, respectively. Initial source tests and recurring screening tests are the next largest cost categories with about $0.4 million (15%) for the low cost scenario and $0.58 million (14%) for the high cost scenarios, annually.

Figure 1:
Annual Estimated Costs by Requirement



The cost impacts for affected facilities from PAR 1469 compliance are from one-time costs and annual recurring costs. The one-time costs would include capital and installation of APC systems, initial source costs, permanent total enclosures, building modifications, permit application fees, and BMPs. Annual recurring cost estimates include costs of APC systems, annual costs of electrical power to run new ventilation blowers, annual monitoring costs, annual permit renewal fees, and costs of periodic source tests.

Table 2:
Projected Total and Average Annual Compliance Cost of PAR 1469 by Requirement Categories

	Total Cost Low Cost Scenario (From 2019 to 2035)	Total Cost High Cost Scenario (From 2019 to 2035)	Annual Cost at 1% Real Interest Rate (Low Cost Scenario)	Annual Cost at 4% Real Interest Rate (High Cost Scenario)
One-Time Costs				
Implementing BMPs**	$654,000	$654,000	$68,000	$76,000
Building Modifications*	$164,000	$272,000	$11,000	$18,000
Capital Cost of New APC Systems for Existing Tier III Tanks*	$6,539,000	$8,584,000	$463,000	$738,000
Capital Cost for New APC Systems for Existing Electrolytic Tanks Controlled by Chemical Fume Suppressants*	$0	$2,744,000	$0	$209,000
Cost of Permanent Total Enclosure*	$184,000	$340,000	$11,000	$24,000
Initial Source Testing for New APC Systems for existing Tier III Tanks*	$1,144,000	$1,736,000	$67,000	$102,000
Initial Source Testing for New APC Systems for Existing Electrolytic Tanks controlled by Chemical Fume Suppressant*	$0	$486,000	$0	$29,000
Initial Source Testing for Existing APC Systems for Existing Electrolytic Tanks*	$1,332,000	$1,332,000	$74,000	$74,000
Permitting Costs for New APC Systems for Existing Tier III Tanks*	$280,000	$420,000	$20,000	$36,000
Permitting for New APC Systems Serving Existing Electrolytic Tanks controlled by chemical Fume suppressants*	$0	$118,000	$0	$8,000
Fluid Eductors**	$30,000	$42,000	$3,000	$5,000
Recurring Costs				
Screening Test (Recurring) Cost for Existing Electrolytic and Tier III Tanks	$2,286,000	$2,286,000	$147,000	$147,000
Screening Test (Recurring) Cost for Tier III Tanks	$1,901,000	$3,071,000	$121,000	$196,000
Screening Test (Recurring) Cost for New APC Systems for Electrolytic Tanks Controlled by Chemical Fume Suppressants	$0	$540,000	$0	$35,000
Annual Monitoring Costs	$180,000	$265,000	$12,000	$18,000
Operating and Maintenance Costs for APC Systems	$17,655,000	$30,680,000	$1,168,000	$2,010,000
Annual Operating (Electrical) Costs	$5,174,000	$6,092,000	$338,000	$368,000
Annual Permit Renewal Costs for Tier III Tanks	$1,904,000	$2,496,000	$118,000	$183,000
Total* **	**$39,788,000**	**$62,156,000**	**$2,648,000**	**$4,258,000**

*Cost is annualized over 15 years of expected equipment life
** Cost is annualized over 10 years of expected equipment life (Splash Guards, Barriers, Pressure Gauge)
***Total values may not add up due to rounding.

Based on the type of operations performed by each facility, 13 categories based on the types of facilities (hard chromium plating, decorative chromium plating, chromic acid anodizing, multiple, trivalent) as well as the size of the facility (small, medium, large, other based on permitted ampere-hours) were established.

Table 3 presents the total and average annual costs of PAR 1469 by type of operation. The majority of the annual compliance costs ($2.46 million for high cost scenario, $1.56 million for low cost scenario, both approximately 58% of total costs across all facility categories) is estimated to be incurred by affected facilities that belong to categories of Anodizing (small), Anodizing (medium), and Anodizing (other). Facility categories denoted by "Other" refers to facilities with a permit still under review at the time of the socioeconomic impact assessment, and ampere-hours information was not available to define the size of the operation.

Table 3:
Projected Total and Average Annual Compliance Cost of PAR 1469 by Operation Category
(2017 Dollars)

Operation Category	Total Cost Low Cost Scenario	Total Cost High Cost Scenario	Annual Cost at 1% Real Interest Rate (Low Cost Scenario)	Annual Cost at 4% Real Interest Rate (High Cost Scenario)
Anodizing (Small)	$9,125,000	$13,174,000	$612,000	$915,000
Anodizing(Medium)	$12,304,000	$19,365,000	$827,000	$1,360,000
Anodizing (Other*)	$1,745,000	$2,754,000	$116,000	$193,000
Decorative (Small)	$5,142,000	$10,809,000	$327,000	$715,000
Decorative (Medium)	$2,664,000	$3,954,000	$171,000	$264,000
Decorative (Large)	$239,000	$710,000	$16,000	$16,000
Decorative (Other)	$181,000	$181,000	$12,000	$12,000
Hard (Small)	$196,000	$459,000	$12,000	$24,000
Hard (Medium)	$556,000	$545,000	$37,000	$38,000
Hard (Large)	$5,712,000	$7,543,000	$388,000	$534,000
Hard (Other)	$142,000	$130,000	$9,000	$9,000
Multiple (Large)	$1,772,000	$2,519,000	$119,000	$178,000
Trivalent (Other)	$0	$0	$0	$0
Total	**$39,788,000**	**$62,156,000**	**$2,648,000**	**$4,258,000**

*"Other" refers to facilities for which the permit was still under review and ampere-hours data was not yet available.

Table 4 presents the compliance cost of PAR 1469 by industry types. The majority of the annual compliance costs ($2.23 million or 84% for low cost scenario and $3.59 million or 84% for the high cost scenario) of PAR 1469 is estimated to be incurred by the sector of fabricated metal manufacturing where most of the electroplating, plating, polishing, anodizing, and coloring facilities belong.

Table 4:
Projected Total and Average Annual Compliance Costs by Industry for Affected Facilities (2017 Dollars)

Industry that Typically Uses the Equipment	NAICS Codes	Number of Facilities	Projected Annual Compliance Costs			
			Total Cost Low Cost Scenario	Total Cost High Cost Scenario	Annual Cost Low Cost Scenario 1% Real Interest Rate	Annual Cost High Cost Scenario 4% Real Interest Rate
Wholesale trade	42	2	$873,000	$1,377,000	$58,000	$96,000
Professional, scientific, and technical services	54	1	$45,000	$45,000	$3,000	$3,000
Fabricated metal product manufacturing	332	92	$33,516,000	$52,448,000	$2,230,000	$3,594,000
Machinery manufacturing	333	3	$600,000	$910,000	$40,000	$62,000
Computer and electronic product manufacturing	334	2	$230,000	$477,000	$15,000	$30,000
Electrical equipment and appliance manufacturing	335	1	$40,000	$76,000	$2,000	$4,000
Furniture and related product manufacturing	337	1	$2,000	$2,000	$0	$0
Administrative and support services	561	4	$925,000	$1,340,000	$62,000	$86,000
Repair and maintenance	811	3	$600,000	$910,000	$40,000	$62,000
Motor vehicles, bodies and trailers, and parts manufacturing	3361-3363	2	$508,000	$819,000	$34,000	$56,000
Other transportation equipment manufacturing	3364-3369	3	$2,403,000	$3,701,000	$162,000	$259,000
Retail trade	44-45	1	$45,000	$45,000	$3,000	$3,000
Total		**115**	**$39,788,000**	**$62,156,000**	**$2,648,000**	**$4,258,000**

One-time Costs of PAR 1469 Compliance

- **Implementing BMPs**

High Cost Scenario:

- Drip trays between electroplating/anodizing tank and adjacent tanks
- Tank labeling on each electroplating, anodizing and Tier III tank
- Barriers – 1 barrier at 111 affected facilities (trivalent facilities are not subject to this requirement)
- Instrumentation for existing APC systems – 2 static pressure gauges, 1 magnahelic, and 1 hot-wire anemometer for each existing APC system
- Cost: $654,000

Low Cost Scenario:

- Assumptions and cost are same as in High Cost scenario
- Cost: $654,000

Installation of Drip Trays

PAR 1469 requires installation of drip trays between each electroplating or anodizing tank and adjacent tanks for facilities with automated lines. A cost of $200 per drip tray is assumed, in addition to 5 hours of labor (performed by plating shop personnel) to install these drip trays. According to the industry representative, labor costs are assumed to be at an hourly wage of $22 per hour, which represents the average labor rate at the affected facilities. The number of drip trays is assumed to be equivalent to the number of existing Tier III Tanks and electrolytic tanks at 111 facilities, distributed evenly among all facilities. This results in an estimated cost of $99,470 for installation of drip trays. This value is used for both the high and low cost scenario. Inclusion of this cost is a conservative assumption, as many facilities with automated lines currently have drip trays.

Installation of Labels on Tanks

PAR 1469 requires clear labeling of tanks within the tank process area with a tank number or other identifier, SCAQMD permit number, bath contents, maximum concentration (ppm) of hexavalent chromium, operating temperature range, and any agitation methods used. However, a cost is included for this BMP in order to be conservative. A cost of $25 per label is assumed. The number of new labels is assumed to be equivalent to the number of existing Tier III Tanks and electrolytic tanks at 111 facilities, distributed evenly among all facilities. This results in an estimated cost of $8,575 for installation of labels on tanks. This value is used for both the high and low cost scenario. Inclusion of this cost is a conservative assumption, as staff believes most facilities currently comply with this requirement.

Installation of Barrier between Buffing, Grinding or Polishing Area and Tank Area

PAR 1469 requires separation of the buffing, grinding, or polishing area within a facility from the chromium electroplating or chromic acid anodizing operation. The proposal allows the barrier to be plastic strip curtains. Therefore, plastic strip curtains are assumed to facilities to comply with this requirement, due to their relatively low cost. A capital cost of $1,000 plus an additional labor cost of 20 hours to install this barrier is assumed for each facility. The total estimated cost to comply with this BMP is $165,000. This value is used for both the high and low cost scenario. Inclusion of this cost scenario is a conservative assumption, as many facilities currently conduct buffing, grinding and polishing activities in a separate room from electroplating or anodizing activities.

Installation of Parameter Monitoring Instrumentation on existing APC Systems

PAR 1469 requires installation of instrumentation to monitor pressure and airflow on existing APC systems. This instrumentation includes a static pressure gauge installed on the push side of a push-pull manifold serving a Tier III or electrolytic tank, a static pressure gauge or volume flow meter installed in the collection manifold of an APC system, and a differential pressure gauge installed across each stage of control in an APC system. An example of the differential pressure monitoring locations required by the proposal includes across the mesh pads, pre-filters, and the HEPA filters. In this instance, three differential pressure monitoring devices would be required per APC system. Costs assumed for this requirement include $200 for a static pressure gauge and $1,000 for a differential pressure gauge. Both costs include installation.

Instrumentation for parameter monitoring is included in the unit cost for new APC systems serving existing Tier III Tanks. Therefore, no additional costs are assumed for new APC systems installed either for Tier III Tanks or for APC systems installed in the event that no chemical fume suppressant is re-certified by July 2021. For existing tanks, most permits already include a requirement to monitor differential pressure either across each stage of control or over all stages of control collectively. Therefore, APC systems for existing tanks already have at least one differential pressure monitor currently installed. Staff does not believe many APC systems are currently equipped with a static pressure gauge either on the push side of a push-pull ventilation system or within the collection manifold. To be conservative, this estimate includes two static pressure monitors and two differential pressure monitors. The APC systems for existing electroplating and anodizing tanks are required to install a parameter monitoring instrumentation. The estimated cost of meeting this BMP requirement is estimated at $316,000. This value is used for both the high and low cost scenario.

The total one-time cost of the above BMPs is estimated at $654,000 for both low and high cost scenarios.

- **Building Modification Costs**

High Cost Scenario:

- 4 openings per facility at 111 affected facilities
- 12 facilities modify existing openings to meet 3.5% enclosure envelope
- Construction based on 400 ft^2 of open area
- Cost: $272,000

Low Cost Scenario:

- Four openings per facility at 111 affected facilities
- 12 facilities modify existing openings to meet 3.5% enclosure envelope
- Construction based on 1,000 ft^2 of open area
- Cost: $164,000

PAR 1469 requires building enclosures that meet a limit of 3.5% enclosure openings as a percentage of the building envelope, which includes the area of the walls of the enclosure, the floor and the horizontal projection of the roof. Facilities with openings in excess of this limit have many options for compliance including enclosing openings by installing doors, windows and wall sections. Most facilities currently meet the proposed limit. In addition, PAR 1469 requires facilities to enclose all roof openings that are located near an electrolytic tank or Tier III Tank. This includes openings within 15 feet of Tier II or Tier III Tank. It is estimated that a maximum of four openings per facility may need to be closed. Simple and cost-effective solutions are readily available to close these openings. An estimate of $200 per opening is used to calculate closure costs. Existing shop personnel are expected to conduct this work. The total cost for building enclosure modifications is estimated to be $92,000, inclusive of materials and labor.

Under the Ongoing Compliance Status & Emissions Report in Appendix 3, the owner/operator is required to identify enclosure openings that contribute to the 3.5% building allowance. The cost to close roof openings within 15 feet of a Tier II or Tier III Tank will reduce the percentage of openings as a function of the building envelope and this cost is calculated under the cost scenario specific to 4 openings per facility requirement. Staff has learned of two situations where a facility may construct in order to meet the 3.5% opening requirement. In a survey of nine facilities, one had large openings high up in the walls that need to be enclosed to meet the 3.5% allowance. In a second situation, a facility has a plating operation in the middle section of a very large building. The facility prefers to keep the doors at either end of the building open and instead would construct interior walls that enclose the plating operation to meet requirements. This solution may require the facility to ventilate the area that houses the plating operation. It can be argued that construction in the second example is not driven by PAR 1469 requirements but is instead a business decision. In the survey mentioned, one out of nine facilities will be required to construct building enclosure modifications as a direct result of PAR 1469 requirements. For this analysis, these limited survey results are conservatively extrapolated to the PAR 1469 universe of 111 facilities that conduct

hexavalent chromium plating or anodizing, giving an estimate of 12 facilities that may be required perform some kind of construction. For the low cost scenario, it is assumed that these facilities will be required to enclose up to 400 square feet and up to 1,000 square feet for the high cost scenario.

It is not possible to predict a solution for the facilities that may need to enclose existing openings. PAR 1469 allows a number of solutions such as permanently sealing existing openings with materials such as light-gauge steel or aluminum siding, closing doors and windows as allowed under the proposal (with two hours per day allowance for ingress and egress of equipment and personnel), installation of plastic strip curtains, or other materials on existing openings in lieu of closing doors and windows. Cost for these solutions are estimated as follows:

> Adding to a section of a wall, including the cost to add panels to a partial enclosure that creates a building enclosure thereby meeting 3.5% limit for openings as a percentage of building envelope: $44,000 for 100 feet section of wall 24 feet high. The wall is assumed to have a steel structure with a light gauge steel sheathing, one roll up door, and two entry doors. The unit cost of the wall was estimated at $18.33 per square feet.[5]
>
> Plastic strip curtains cost an average of $7 in the size ranges expected for building enclosure applications (eight feet by three feet for personnel access doors; 12 feet by 16 feet for equipment access doors. An additional 50% is added for installation costs, giving an estimated unit cost of $10.50 per square foot.[6]

Assuming half of building enclosures will be closed using solid wall surfaces and 50% will use plastic strip curtains results in an average cost of approximately $15 per square foot. For the low cost scenario, it is assumed that up to 400 square feet of surface area will be enclosed, for an estimate of $6000, and for the high cost scenario, it is assumed that 1,000 square feet of surface area will be enclosed, giving an estimated $15,000. For the 12 facilities estimated to be impacted by this requirement the total cost will range from $72,000 to $180,000.

[5] National Building Cost Manual 2008. Costs were updated to current dollars.

[6] https://www.grainger.com/category/strip-doors/strip-doors-replacement-strips-and-hardware/dock-equipment/material-handling/ecatalog/N-18lo?okey=plastic+strip+curtains&mkey=plastic+strip+curtains&refineSearchString=plastic+strip+curtains&NLSCM=14&EndecaKeyword=plastic+strip+curtains&searchBar=true&searchRedirect=plastic+strip+curtains&sst=subset

- **Capital Cost of New APC Systems for Existing Tier III Tanks**

High Cost Scenario:

- 130 new APC systems at 70 affected facilities
- One APC system per Tier III tank
- Cost: $8,584,000

Low Cost Scenario:

- 64 new APC systems at 55 affected facilities
- Multiple Tier III Tanks per APC system
- Cost: $6,539,000

PAR 1469 would require affected facilities to install APC systems on hexavalent chromium-containing tanks that emit or have the potential to emit hexavalent chromium from their Tier III Tanks. In addition, Tier III Tanks that are currently exempt under Rule 219 often do not have tank parameters (i.e. size, applied heat or air sparging, chromium concentration within the bath) described in their SCAQMD permits. As a result, staff does not have data on all Tier III tanks affected by PAR 1469. To better estimate the number of Tier III Tanks affected, staff administered two surveys requesting data from affected facilities; one administered by SCAQMD compliance staff (Phase I), and the other completed by the owner or operator of a facility (Phase II).

Phase I of the survey consisted of information regarding tanks, housekeeping procedures, best management practices, and existing control techniques. Of the 115 affected facilities that were contacted, a total of 62 responses were received. Phase II was conducted mainly to obtain information from additional facilities that could be affected by the amendments as well as financial data (annual sales and number of employee) of all affected sources subject to the PAR 1469.

25 of the 62 survey responses received included the size and composition of Tier III Tanks. Data from these responses were extrapolated to estimate the number and size of Tier III Tanks at facilities that did not submit a survey response. In order to establish these estimates, 13 facility categories were created, based on the type of operations performed by the facility (hard chromium plating, decorative chromium plating, chromic acid anodizing, multiple operations, and trivalent) as well as the size of the facility (small, medium, large, and other). Facility size designations were based on the number of ampere-hours allowed in a facility's permit. Small facilities are those permitted for less than 500,000 ampere-hours/year, medium facilities are those permitted for 500,001 to 10,000,000 ampere-hours/year, and large facilities are those permitted above 10,000,000 ampere-hours/year. Facilities designated as "Other" had a permit under review at the time of the analysis and ampere-hours could not be confirmed. These categories are shown below:

1. Chromic Acid Anodizing (Small)
2. Chromic Acid Anodizing (Medium)
3. Chromic Acid Anodizing (Other)
4. Decorative Chromium Plating (Small)
5. Decorative Chromium Plating (Medium)
6. Decorative Chromium Plating (Large)

7. Decorative Chromium Plating (Other)
8. Hard Chromium Plating (Small)
9. Hard Chromium Plating (Medium)
10. Hard Chromium Plating (Large)
11. Hard Chromium Plating (Other)
12. Multiple Plating or Anodizing Operations (Large)
13. Trivalent (Other)

It should be noted that facilities designated as small for the purpose of estimating costs do not necessarily qualify them as a small business under the small business definition.

Tank estimates and associated costs are based on the number of survey responses within each category as described above, scaled to the total number of facilities with Tier III Tanks within that category. Average costs were assigned to each facility as a percentage of the total costs within that category for a particular capital cost or activity.

High Cost Scenario for APC Systems

There are a total of 27 facilities with chromium electroplating and/or anodizing tanks that are currently controlled only by chemical fume suppressants. Out of these 27, 12 facilities have both electroplating/anodizing tanks and Tier III Tanks. The remaining 15 facilities only have electroplating/anodizing tanks and represent some of the smallest facilities in the PAR 1469 universe. Under the high cost scenario, it is assumed that a total of 130 (i.e. 103 Tier III Tanks and 27 tanks controlled by fume suppressants) located at 70 (i.e. 55 facilities with existing Tier III Tanks and 15 facilities with fume suppressant controlled tanks) facilities will require APC controls. Under this scenario, one APC system is assumed for each tank.

Under a high cost scenario, an additional 27 APC systems are assumed to be installed at 27 facilities if no certified chemical fume suppressants are available by July 2021. 12 of these facilities already have Tier III Tanks that also need APCs, and are counted in the first group. The remaining 15 facilities do not have Tier III Tanks now and would need a new APC after 2022. The total APC system counts under the high cost scenario is therefore 130 (103+27) systems at 70 (55+15) facilities.

Low Cost Scenario for APC Systems

Under the low cost scenario, it is assumed that a total of 103 tanks located at 55 facilities will require APC controls. Under this scenario it is assumed that a re-certified chemical fume suppressant will be available by 2021, and that the 27 facilities currently using chemical fume suppressants as their only form of control will be able to use a re-certified chemical fume suppressant rather than installing APC systems. In addition, the low cost scenario assumes that where possible, facilities with higher ventilation needs will be able to vent more than one Tier III Tank into a single APC system and as a result, only 64 APC systems would be installed at 55 facilities. Table 5 presents the summary of the estimated number of Tier III Tanks and associated APC systems for both scenarios.

Table 5:
Affected Facilities and Tanks

High Cost Scenario		Low Cost Scenario	
# of Facilities	70	# of Facilities	55
# of Tier III Tanks	130	# of Tier III Tanks	103
# of APCs	130	# of APCs	64

SCAQMD staff used a number of sources to estimate capital and annual costs for new air pollution control systems, including estimates from the 2006 CARB chrome plating ATCM. These cost estimates were updated to 2017 dollars. Costs from recent quotes correlate very well with updated costs from the CARB ATCM. After review of the available cost data, the updated CARB ATCM costs represented the most conservative assumptions. All raw costs were converted to unit costs and are presented in dollars per cubic feet per minute (cfm) of APC system airflow. Three system sizes were estimated, including 5,000 cfm, 10,000 cfm and 20,000 cfm. It was assumed that 150 cfm of airflow is required to control each square foot of tank surface area. This assumption was used both for electroplating/anodizing tanks as well as for Tier III Tanks. The three system sizes of 5,000 cfm, 10,000 cfm and 20,000 cfm correspond to control of tanks with a surface area of approximately 33 square feet, 67 square feet, and 133 square feet, respectively.

All cost estimates are assumed to include the following:

1. Engineering and system design
2. Ventilation ductwork
3. Blower motor and housing
4. Control housing
5. Control media (i.e. mesh pads, pre-filters, HEPA filters, etc.)
6. Instrumentation required under PAR 1469, including:
    a. Static pressure gauge on push side of push/pull system;
    b. Static pressure gauge or volumetric flow meter at collection manifold; and
    c. Differential pressure gauge measuring pressure drop across each stage of control.
7. Installation
8. Required electrical upgrades
9. Sales tax
10. Set-up and commissioning

Quotes obtained from vendors indicate that unit costs decrease as APC systems increase in size. Unit costs used in this analysis are as follows:

System Size (cfm)	Unit Cost Estimate (per cfm)
Up to 5,000	$23
5,001 to 10,000	$17
10,001 to 20,000	$14

Unit cost estimates do not include source testing or permitting. However, the analysis provides separate line items for source testing and permitting. In addition, unit cost estimates do not include costs that the city or municipality may impose relative to building inspections, approvals and

upgrades to meet local building codes for the facility. For example, a facility may need to meet the current building code or seismic requirements. However, no costs were assumed for items such as building inspections, approvals, and upgrades imposed by the city or municipality, due to the uncertain nature of these costs. Each city or municipality may have different requirements relative to installation of APC systems, and staff cannot reasonably predict these costs. Therefore, actual costs may be higher for facilities with older buildings that need to be brought up to current codes.

Staff assumed that most tanks will require an APC system sized to control emissions from that individual tank. The assumption of one APC system per tank was made after consultation with Environomics and after numerous SCAQMD staff visits to facilities subject to Rule 1469. This is a conservative assumption as staff believes there are many opportunities for a plating or anodizing facility to realize savings under one or more of the following scenarios:

1. Venting multiple tanks to a common APC system, where these tanks are located in proximity to each other;
2. Moving tanks that are not currently located in proximity with each other closer together and venting to a common APC system; or
3. Venting an existing tank required to be controlled under PAR 1469 into an existing APC system, where capacity of that system allows.

It should be noted that there is a financial incentive for combining multiple tanks into a common APC system, relative to installing a single APC system for each tank, in terms of reduced unit cost as well as reduced source testing, permitting, and annual permit renewal fee costs. Therefore, actual costs will probably be lower for many facilities than costs calculated for the high cost scenario.

For the high cost scenario, the unit cost was assumed to be $23 per cfm for most APC systems, which correlates with the smallest APC system size. A unit cost of $17 per cfm was assumed for tanks requiring an APC system of up to 10,000 cfm. For the low cost scenario, it was assumed that 55 facilities that are required to control 103 tanks under PAR 1469 would combine tanks to create the largest possible system, resulting in a lower overall cost. It is further assumed that installation of new APCs systems for Tier III Tanks starts in 2019 and 2020, respectively.

The total cost of installing the APC systems is estimated at $6.5 to $11.3 million, for low cost and high cost scenarios, respectively. The total average annual cost of installing the APCs are estimated at $0.46 to $0.97 million over 15 years, depending on the real interest rate assumed (1% for the low cost scenario) and (4% for the high cost scenario), respectively.

Based on the approach described, staff initially estimated 137 existing Tier III Tanks at 55 chromium plating and anodizing facilities would need to be controlled as a result of PAR 1469 requirements. It was assumed that facilities will use a lower cost option than installing APC systems where available. This could be the case for tanks that are currently air sparged, such as chem-film and passivation tanks. By removing air sparging, these tanks become Tier I Tanks. This analysis assumes these tanks will be retrofitted with fluid eductors, rather than continuing to be air sparged, resulting in much a lower overall cost to the facility. There are an estimated 20

chem film and passivation tanks that fall under this assumption, all located at facilities within Chromic Acid Anodizing (Medium) facilities.

Of the Tier III Tanks, 46 tanks in the Decorative Chromium Plating (Small), Decorative Chromium Plating (Medium) and Hard Chromium Plating (Large) facility categories are used to conduct either electropolishing or reverse plating (i.e. stripping) operations. Liquid sampling was conducted at 10 facilities to determine hexavalent chromium concentrations from these tanks. Tanks with hexavalent chromium concentrations in excess of 1,000 ppm are considered Tier III Tanks under PAR 1469, and tanks with concentrations under 1,000 ppm are not regulated. Sample results of tanks under 1,000 ppm within each facility category were scaled by the number of stripping/electropolishing tanks within that facility category to determine the number of tanks not expected to need controls. After adjusting for eductors used in passivation and chem film tanks, and for stripping/electropolishing tanks, the adjusted number of new APC systems serving existing Tier III Tanks is 103 for the high cost scenario and 64 for the low cost scenario.

- **Capital Cost for New APC Systems for Existing Electrolytic Tanks Controlled by Chemical Fume Suppressants Only**

High Cost Scenario:

- 27 new APC systems
- Chemical fume suppressants will not be recertified prior to 2021
- Cost: $2,744,000

Low Cost Scenario:

- no new APC systems
- Chemical fume suppressants will be recertified prior to 2021
- Cost: $0

In addition to new APC systems for Tier III Tanks, this analysis also includes cost estimates for APC systems for existing tanks that are currently controlled only by certified chemical fume suppressants. There are a total of 27 facilities with chromium electroplating and/or anodizing tanks that are currently controlled only by certified chemical fume suppressants.

It is assumed that all tanks located at facilities that are complying with the current requirements of Rule 1469 using only fume suppressants will delay any decisions on installing APC systems until after SCAQMD provides notice to facilities in January 2020 regarding the availability of re-certified chemical fume suppressants. It is further assumed that all facilities will install one APC system for all electroplating/anodizing tanks located at the facility. These assumptions recognize the small size of facilities currently using certified chemical fume suppressants and the likelihood that most of these facilities have a single electroplating or anodizing tank. Therefore, 27 additional APC systems were assumed to be installed to control emissions from electroplating/anodizing operations at these facilities in the event that chemical fume suppressants are not re-certified by SCAQMD and CARB.

- **Cost of PTEs**

High Cost Scenario:

- 2 PTEs will be triggered
- Ventilation system based on 15 air changes per hour
- Cost: $340,000

Low Cost Scenario:

- 2 PTEs will be triggered
- Ventilation system based on 6 air changes per hour
- Cost: $184,000

The PAR 1469 requirement for a PTE is triggered by one of several proposed provisions. These include:

1. More than one failure of a source test within 48 months; or
2. Two failures to cease operating a tank controlled by air pollution control (APC) system within 48 months for facilities located more than 1,000 feet from a sensitive receptor or a school; or a single failure for facilities located less than 1,000 feet from a sensitive receptor or a school, after a:
   (i) Failed parameter monitoring measurement (i.e. slot velocity or smoke test) of an APC system; or
   (ii) Failed smoke test of an add-on non-ventilated APC device (i.e. tank cover or Merlin Hood).

Within 180 days after PAR 1469 is adopted, enclosure openings for both building enclosures and PTEs are required to be less than 3.5% of the building envelope (i.e. area of walls plus floor and horizontal projection of ceiling on the floor). This requirement would be in effect before any PTE can be triggered. This means all necessary building construction would be done prior to a PTE being required. In addition to meeting the enclosure opening requirement, a PTE will require the installation of a ventilation system designed to meet the face velocity requirements of EPA Method 204. This is the only construction assumed if a PTE is triggered. Staff believes the likelihood of triggering construction of a PTE under any of the scenarios listed above is very low. To be conservative, an estimate of two PTEs was used.

The ventilation rate assumed for the low cost scenario is based on six air changes per hour (ACH) and based on 15 ACH for the high cost scenario. This equates to 4,000 cfm to 10,000 cfm for an average size building (40,000 cubic feet of volume).

It is assumed that the APC system consists of similar makeup to a dedicated system serving a Tier III Tank; that is, a mist eliminator followed by pre-filter and HEPA filters as final control. As such, the cost of installation of an APC system as described before is $23 per cfm for the 4,000 cfm system, and $17 per cfm for the 10,000 cfm system. It is further assumed that no building construction will be necessary to meet the PTE requirements, since PAR 1469 already requires

that openings for a building enclosure do not exceed 3.5% of the building envelope, and all necessary construction has already taken place. The estimated cost of the two PTEs is therefore $184,000 for the low cost scenario, and $340,000 for the high cost scenario. Annual operating costs for the two PTEs are estimated as 18% of the capital cost,[7] plus electricity to operate the ventilation blower. This O&M cost was already also assumed for APC systems serving Tier III Tanks.

- **Initial Source Testing for New APC Systems for existing Tier III Tanks**

High Cost Scenario:

- 103 initial source tests for new APC systems
- One APC system per Tier III Tank
- Cost: $1,736,000*

Low Cost Scenario:

- 64 source tests for new APC systems
- Multiple Tier III tanks per APC system
- Cost: $1,144,000

*Cost is adjusted for removal of stripping tanks within Decorative (small) and Decorative (medium) categories based on low concentrations (less than 1000 ppm) of hexavalent chromium measured during sampling.

PAR 1469 requires an initial source test for new APC systems to measure emissions and establish system parameters. This requirement will affect 103 Tier III Tanks at 55 facilities. For the high cost scenario, it was assumed that one APC system is necessary for each tank resulting in 103 APC systems. For the low cost scenario, it is assumed that facilities with Tier III Tanks will take advantage of the cost savings of a larger system serving multiple tanks and 64 APC systems would serve 103 Tier III Tanks. Staff received a quote from a source testing contractor that performs the majority of source tests for facilities subject to PAR 1469. The current cost of a conventional source test consisting of three individual collection runs according to a SCAQMD approved protocol is $18,000. The total estimated costs for source tests conducted on APC systems serving 103 Tier III Tanks ranges from $1,144,000 for the low cost scenario to $1,736,000 for the high cost scenario. It is further assumed that initial source tests for new Tier III Tanks start in 2020 and 2021 and that for electrolytic tanks starts in 2022, respectively.

[7] 18% O&M for PTE is based on information provided by industry economist consultant

- **Initial Source Tests for Existing APCs for Existing Electrolytic Tanks**

High Cost Scenario:

- 25 initial source tests for existing APC systems if most recent source test was conducted before January 2009 at $18,000 each
- 64 emission screening tests for existing APC systems if most recent source test was conducted before January 2009 at $14,000 each
- Cost: $1,332,000

Low Cost Scenario:

- Same as High Cost Scenario
- Cost: $1,332,000

PAR 1469 requires a source test for existing equipment. Some APCs serving existing electrolytic tanks were tested following the previous amendment to Rule 1469 in 2008. In order to minimize the cost of this requirement to industry, APCs with source tests that were conducted after January 2009 are allowed to conduct an emissions screening test to satisfy the initial source testing requirement. In addition, PAR 1469 allows facilities with a source test conducted after January 2015 to satisfy the requirement for an initial source test. An emissions screening test consists of a single run and is estimated to cost $14,000. It is estimated that it will cost $1,332,000 to source test 89 APC systems serving electrolytic tanks, for both the low cost and high cost scenarios.

- **Initial Source Tests for New APC Systems for Existing Electrolytic Tanks controlled by Chemical Fume Suppressants Only**

High Cost Scenario:

- 27 initial source tests for new APC systems serving tanks formerly controlled by chemical fume suppressants
- Chemical fume suppressants will not be re-certified prior to 2021
- Cost: $486,000

Low Cost Scenario:

- No initial source tests for tanks controlled by chemical fume suppressants
- Chemical fume suppressants will be re-certified prior to 2021
- Cost: $0

The high cost scenario assumes that certified chemical fume suppressant would not be re-certified prior to the July 2021 date in PAR 1469, and would require that APC systems at facilities that currently use certified chemical fume suppressants are necessary to comply with the emission limits. If this occurs, 27 new APC systems would be required at 27 facilities. The estimated cost to source test these APC systems is $486,000. The low cost scenario assumes a chemical fume

suppressant will be re-certified and available by July 2021 and no APC systems are necessary, resulting in no additional cost.

The total initial source test cost are estimated at $2,476,000 to $3,554,000 for low and high cost scenarios, respectively.

- **Permitting Costs for New APC Systems for Existing Tier III Tanks**

High Cost Scenario:

- 103 permit applications for new APC systems
- One APC system per Tier III Tank
- Cost: $420,000

Low Cost Scenario:

- 64 permit applications for new APC systems
- Multiple Tier III tanks per APC system
- Cost: $280,000

A permit application fee is submitted with the permit application for each new APC system required by PAR 1469. The estimated number of Tier III Tanks required to be controlled is 103 Tier III Tanks at 55 facilities, as previously described. The applicable permit fee schedule is Schedule C, which is $4,354 for each permit required. As previously described, the high cost scenario assumes individual APC systems for each tank, resulting in a total one-time cost of $420,000. The low cost scenario assumes 64 APC systems will be necessary to control emissions from 103 Tier III Tanks, resulting in a one-time permitting application fee cost of $280,000.

- **Permitting for New APC Systems Serving Existing Electrolytic Tanks controlled by Chemical Fume Suppressants Only**

High Cost Scenario:

- 27 permit applications for new APC systems serving tanks formerly controlled by chemical fume suppressants only
- Chemical fume suppressants will not be re-certified prior to 2021
- Cost: $118,000

Low Cost Scenario:

- No permit applications for tanks controlled by chemical fume suppressants only
- Chemical fume suppressants will be re-certified prior to 2021
- Cost: $0

If re-certification of a chemical fume suppressant is not made available for existing electrolytic tanks by July 2021, the installation of new APC systems would be required by PAR 1469.

Permitting costs associated with the new APC systems are $118,000. The low cost scenario assumes availability of a re-certified chemical fume suppressant, and would result in no installation of an APC system and no permitting costs accordingly.

- **Fluid Eductors**

High Cost Scenario:

- 20 passivation and chem film tanks will use fluid eductors rather than controlling tanks with an APC system
- Cost quote obtained by Environomics (MFASC consultant)
- Cost: $42,000

Low Cost Scenario:

- 20 passivation and chem film tanks will use fluid eductors rather than controlling tanks with an APC system
- Cost quote obtained by SCAQMD staff
- Cost: $30,000

As previously described, it is assumed that facilities would choose to use a lower cost option over installing APC controls where available. For tanks that are currently air sparged, but where chromium concentrations are low enough to be considered Tier I Tanks without air sparging, such as chem-film and passivation tanks, a lower cost option is available in the form of fluid eductors. This analysis assumes these tanks will be retrofitted with fluid eductors, rather than continuing to be air sparged, resulting in much lower overall cost as compared to installing and maintaining an APC system. Since there are no moving parts within fluid eductors, there is no maintenance cost. There are an estimated 20 chem film and passivation tanks that can make use of this option. SCAQMD staff obtained an estimated cost of $1,500 for fluid eductors sized to fit an average tank. This value is used for the low cost scenario. MFASC consultant Environomics obtained a similar quote of $2,100 per average tank, and this value is used for the high cost scenario. The capital costs for fluid eductors in PAR 1469 is estimated at $30,000 and $42,000 for low cost scenario and high cost scenario, respectively.

Annual O&M Costs of APC Systems and Other Recurring Costs

Annual cost estimates include annual O&M costs of APC systems, annual costs of electrical power to run new ventilation blowers, parameter monitoring, annual permit renewal fees, and annual costs of periodic (every five to seven years) source tests required under PAR 1469.

- **Screening Source Test (Recurring) Costs for Existing Electrolytic and Tier III Tanks**

High Cost Scenario:

- 219 source tests every 5 to 7 years
- 103 emission screening tests for new APC systems serving Tier III tanks + 89 screening source test for existing APC systems serving electrolytic tanks + 27 screening source tests for new APC systems serving tanks formerly controlled by chemical fume suppressants
- Cost: $5,897,000 total for years 2019 to 2035 (present value), see Table 2 Screening Test (Recurring) categories

Low Cost Scenario:

- 153 source tests every 5 to 7 years
- 64 emission screening tests for new APC systems serving Tier III tanks + 89 emission screening tests for existing APC systems serving electrolytic tanks
- Cost: $4,187,000 total for years 2019 to 2035 (present value), see Table 2 Screening Test (Recurring) categories

PAR 1469 requires source tests to be conducted every five to seven years for new and existing APC systems. The compliance dates for initial source tests are staggered by 180 days, depending on when the APC system is required to be installed. For chromic acid anodizing facilities, the initial source test is required by October 2020 and next subsequent test within five to seven years, by 2025 or 2027. For hard chrome plating facilities the initial test would be due in April 2021 and the subsequent test in 2026 or 2028. For decorative plating facilities, the initial test would be due in October 2021 and the subsequent test in 2026 or 2028.

For the high cost scenario, it is assumed that a total of 219 source tests are required every five to seven years. This would include source tests for 103 APC systems serving 103 Tier III Tanks, 89 APC systems serving electrolytic tanks, and 27 APC systems serving electrolytic tanks currently controlled by certified chemical fume suppressants only. It is assumed that each test will be a screening test only, at a cost of $14,000. For the low cost scenario, it is assumed that a total of 153 source tests are required every five to seven years. This would include source tests for 64 APC systems serving 103 Tier III Tanks and 89 APC systems serving electrolytic tanks. The total annual source test cost for the low and high cost scenarios are estimated at $268,000, and $378,000, respectively.

- **Annual Monitoring Costs**

High Cost Scenario:

- 412 labor hours for smoke tests
- 348 labor hours for inlet slot velocity measurements
- 103 new APC systems serving Tier III tanks + 89 existing APC systems serving electrolytic tanks + 27 new APC systems serving tanks formerly controlled by chemical fume suppressants
- Cost: $265,000 total for years 2019 to 2035 (present value)

Low Cost Scenario:

- 236 labor hours for smoke tests
- 306 labor hours for inlet slot velocity measurements
- 64 new APC systems serving Tier III tanks + 89 for existing APC systems serving electrolytic tanks
- Cost: $180,000 total for years 2019 to 2035 (present value)

PAR 1469 requires parameter monitoring to be conducted every six months. The requirements include conducting a smoke test to determine acceptable capture efficiency of the APC system, and inlet velocity measurements of the APC system to ensure they are operating at or near their design velocity. Smoke tests are an existing requirement and will only affect new APC systems. A conservative estimate of two hours per smoke test is assumed for this analysis. It is also assumed that existing shop personnel will conduct smoke tests. Under PAR 1469, 64 to 103 new APC systems will need to be tested twice per year, for a total of 236 to 412 labor hours. It is further assumed that labor rates for shop personnel are approximately $22 per hour which would result in a total estimated annual cost of $5,192 to $9,064 for shop personnel to conduct smoke tests.

Measurement of APC system inlet velocity is a new requirement that will affect existing as well as new APC systems. There are 89 existing systems, and from 64 to 103 new APC systems will be required under PAR 1469 for the low and high cost scenario, respectively. It is assumed that one hour per inlet velocity measurement will be required for this task. It is also assumed that existing shop personnel will conduct inlet slot velocity measurements. For the low cost scenario, 153 inlet slot velocity measurements (64 new +89 existing) will be conducted twice per year, for a total of 306 labor hours. Under the high cost scenario 192 inlet slot velocity measurements (103 new + 89 existing) will be conducted twice per year, for a total of 384 labor hours. It is further assumed that labor rates for shop personnel are approximately $22 per hour, which would result in a total annual estimated cost of $6,512 to $8,448 for shop personnel to conduct inlet slot velocity measurements.

For the inlet slot velocity measurements, it is also assumed that one hot-wire anemometer capable of logging data will be purchased for this task. A suitable hot wire anemometer can be purchased

for $600, resulting in a total cost of $66,600 for the 111 facilities that conduct hexavalent chromium electroplating or chromic acid anodizing.[8]

- **O&M Costs of APC Systems**

High Cost Scenario:

- 18% of capital cost of new APC systems
- 103 new APC systems serving Tier III tanks + 27 new APC systems serving tanks formerly controlled by chemical fume suppressants
- Cost: $30,680,000 total for years 2019 to 2035 (present value)

Low Cost Scenario:

- 18% of capital cost of new APC systems
- 64 new APC systems serving Tier III tanks
- Cost: $17,655,000 total for years 2019 to 2035 (present value)

O&M costs include replacement filters, disposal of filters, and general maintenance, which includes labor to maintain APC systems. Staff used the methodology in the 2006 CARB Chromium Electroplating ATCM, which is based on a percentage of the total capital plus installation costs for the APC systems. The cost of electrical power usage was included in the CARB ATCM methodology but is adjusted here due to the fact that this analysis includes a separate line item for electrical power consumption. Therefore, a consistent ratio of 18% of the capital and installation costs is assumed for O&M for operating the APC systems.[9] The annual O&M cost of PAR 1469 is estimated at $1,168,000, and $2,010,000 for low cost scenario and high cost scenario, respectively.

Assumptions for APC Systems Serving High Temperature Tier III Tanks

Representatives of the metal finishing industry have reported that controlling emissions from tanks heated above 170 degrees may be problematic with regard to removing moisture from the effluent stream prior to final filtration. PAR 1469 requires an air pollution control system controlling Tier III Tanks to meet an emission limit of 0.0015 mg/amp-hr and it is assumed for this analysis that HEPA filtration (99.97% control efficiency at 0.3 μm) will be necessary to achieve this emission limit. HEPA filters work best in a dry air stream. Moisture in the form of mist, condensing water vapor and aerosols of liquid water is typically removed prior to final filtration using a mist eliminator or scrubbers. However, in a heated effluent stream that may be saturated, it is more difficult to remove moisture. Limited data suggests that it may be necessary to replace HEPA

[8] https://www.grainger.com/category/air-velocity-meters-and-anemometers/air-movement/test-instruments/ecatalog/N-b83?okey=hot+wire+anemometers&mkey=hot+wire+anemometers&refineSearchString=hot+wire+anemometers&NLSCM=14&EndecaKeyword=hot+wire+anemometers&searchRedirect=hot+wire+anemometers&sst=subset&suggestConfigId=

[9] 18% O&M for APC systems are based on information provided by industry economist consultant

filters more often in an APC system venting high temperature tanks than in an ambient-temperature air stream, due to the lower tolerance of HEPA filters in a saturated or near-saturated air stream.

One engineered solution suggested by representatives of the metal finishing industry (environmental consultants) is to introduce an additional volume of dry, ambient-temperature air to reduce the relative humidity. They provided an initial estimate of the necessary excess air to be 30%, with the caveat that this volume may need to be refined after installation. There are an estimated 40 tanks that are heated to 170 degrees or higher. These tanks are all located at facilities within the Anodizing (Medium) category. Therefore, the ventilation rate for 40 tanks located within the Anodizing (Medium) category is increased by 30% to account for this additional air. This assumption is made for both the low and high cost scenarios. A HEPA filter cost rated for 2000 cfm air flow at a differential pressure of two inches of water column is estimated at $611.[10]

The estimated average airflow for an APC system serving a Tier III Tank in the Anodizing (Medium) bin is 12,810 cfm. Raising this value by 30% results in an estimated 16,653 cfm. It is assumed that nine HEPA filters will be necessary for this size system.

- **Screening Source Test (Recurring) Cost for Tier III Tanks**

All recurring costs are already accounted for under 'Screening Source Test (Recurring) Cost for Existing Electrolytic and Tier III Tanks.'

- **Screening Source Test (Recurring) Cost for New APC Systems for Electrolytic Tanks Controlled by Chemical Fume Suppressants**

All recurring costs are already accounted for under 'Screening Source Test (Recurring) Cost for Existing Electrolytic and Tier III Tanks.'

- **Annual Operating (Electrical) Costs**

High Cost Scenario:

- 2,615,000 kWh/yr
- Additional 30% excess air assumed for high temperature tanks
- Cost: $6,092,000 total for years 2019 to 2035 (present value)

Low Cost Scenario:

- 2,300,000 kWh/yr
- Standard assumptions – no excess air
- Cost: $5,174,000 total for years 2019 to 2035 (present value)

Survey data from existing APC systems was used to estimate power consumption as a function of blower size. From the survey results, it was determined that each horsepower of motor rating was associated with 550 cfm of ventilation air moving through ventilation systems installed in a typical chromium electroplating or chromic acid anodizing facility. The average size of a ventilation

[10] https://www.grainger.com/category/hvac-and-refrigeration-air-filters-hepa-filters/ecatalog/N-qbp/Ntt-hepa+filters?sst=subset&ts_optout=true

system estimated for each category of facilities was then correlated with motor horsepower that is required to move an equivalent volume of ventilation air. Total system motor horsepower was then converted to kilowatt-hours (kWh) of power per year required, assuming an average operating schedule of 12 hours per day and five days per week. Using this approach and a unit cost of $0.14-0.15/kWh results in a cost estimate of $338,000 and $368,000 annually for low and high cost scenario for electrical power to run ventilation blowers for the new APC systems required under PAR 1469.[11]

- **Annual Permit Renewal Costs for Tier III Tanks**

High Cost Scenario:

- 130 permit renewals for new APC systems
- One APC system per Tier III tank
- Cost: $2,496,000 total for years 2019 to 2035 (present value)

Low Cost Scenario:

- 64 permit applications for new APC systems
- Multiple Tier III tanks per APC system
- Cost: $1,904,000 total for years 2019 to 2035 (present value)

An annual permit renewal fee is charged for each new permit required under PAR 1469. This includes APC systems serving 103 Tier III Tanks, as previously discussed. The annual permit renewal fee for Schedule C is $1,409 for calendar year 2018 and thereafter. As previously described, the high cost scenario assumes individual APC systems for each Tier III Tank, resulting in 103 new APC systems and an annual permit renewal cost of $145,000. The low cost scenario assumes 64 APC systems will be necessary to control emissions from 103 Tier III Tanks, resulting in an average annual permit renewal fee of $83,000. It is further assumed that the annual permit renewal cost starts in 2020.

The high cost scenario also includes annual permit renewal fees for APCs serving existing electrolytic tanks installed due to no chemical fume suppressants being re-certified after July 2022. The cost of annual permit renewal fees for these 27 APC systems is $38,043. Total annual permit renewal costs are estimated at $183,000 for the high cost scenario and $118,000 for the low cost scenario, respectively.

[11] https://www.electricitylocal.com/states/california/los-angeles/

FACILITY-BASED IMPACT ANALYSIS

The 2014 Abt audit report recommended that the SCAQMD expand its small business impacts analysis in its socioeconomic assessments. Specifically, Abt recommended staff to limit the scope of its small business impact analyses to the direct compliance expenditures of regulated facilities. To provide context for the estimated compliance costs for small business, Abt recommended that SCAQMD compare these costs to the annual revenues and/or profits of small business. For publicly traded companies, it was recommended to obtain revenue and profit data from existing databases such as Dun & Bradstreet or Hoover's. For private companies, Abt recommended that SCAQMD compare costs to the revenues and/or profits of the average small business in an industry based on industry-specific revenue data from the Economic Census and industry-specific profit margin data from the Risk Management Association's Annual eStatement Studies series.

SCAQMD conducted a facility-based impact analysis in order to provide further information on the potential impacts of PAR 1469 for small businesses.[12] This analysis measures the annual compliance cost a facility may incur under the proposed amendments relative to its annual revenues. While this section provides information about how compliance costs affect an individual facility, it does not describe broader economic impacts, such as the impact on jobs and other socioeconomic effects, which are described in the following section of this report. The compliance cost is categorized by the different facility types as summarized in Table 6, which provides the basis of the cost data for this analysis. There are a few different sources of revenue and sales data that can be utilized for this type of analysis and they are discussed below.

- **Revenue Data**

Staff has examined a number of different data sources to help understand the amount of revenue for affected facilities. The first data source described here, which helps provide a baseline for this analysis, is from the 2012 U.S. Economic Census.[13] The Industry Statistics for Subsectors and Industries by Employment Size includes data by both detailed industry level (six digit NAICS), and by number of employees per establishment. Table 6 describes the data for the electroplating, plating, polishing, anodizing, and coloring industry (NAICS 332813), which comprises the vast majority of affected facilities under PAR 1469. According to these data, the majority of establishments fall within the less than four employee category. The average revenue per establishment ranges from $264,000 for the smallest category of facilities to over $24 million for the largest category of facilities, with an average of $3 million per facility. The revenue per employee tends to increase with the size of the establishment, with an average of $137,200 per employee for all establishments in the United States. The revenue per employee across all establishments in this industry in the four-county SCAQMD region is $107,000.[14]

[12] Based on methodological recommendations from Industrial Economics (2017): http://www.aqmd.gov/docs/default-source/clean-air-plans/socioeconomic-analysis/iec_smallscalebizrpt.pdf .

[13] U.S. Census Bureau. Manufacturing Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31SG2&prodType=table

[14] U.S. Census Bureau. Manufacturing Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012.

Table 6:
2012 Establishment Annual Revenue by Employment Size for the Electroplating, Plating, Polishing, Anodizing, and Coloring Industry (NAICS 332813)[15]

Size of establishment	Revenue* per establishment	Revenue* per employee
0 to 4 employees	$264,071	$83,235 to $208,088
5 to 9 employees	$835,424	$123,098
10 to 19 employees	$1,558,802	$110,395
20 to 49 employees	$3,946,687	$125,509
50 to 99 employees	$10,179,833	$144,977
100 to 249 employees	$24,141,949	$173,178
250 to 499 employees**	n/a	n/a
500 to 999 employees**	n/a	n/a
All establishments	$2,977,510	$137,242

*Total value of shipments and receipts for services (2012 dollars)
** There were no facilities within NAICS 332813 found in the category of 250 to 499, 500 to 999 employees

Another data source considered for this analysis was the Dun & Bradstreet Enterprise Database. This database is used by staff to help classify potential affected facilities as small businesses as described in the previous section and it includes data on facilities' annual revenues and number of employees. Data on employment and revenue are available for 104 of the 115 affected facilities. Based on the available information, these data are considered to have a high level of confidence because it tracks with facility data, but nonetheless there is still some level of uncertainty associated with these estimates. In the following tables, the data are summarized according to size of establishment and the facility classification types used in development of PAR 1469. The data are first summarized by facility employment size in Table 7. Based on these data, the total annual revenue for affected facilities for which data are available is nearly $1 billion dollars and the total number of employees directly employed by affected facilities is about 5,300. The average annual revenue for the affected facilities is approximately $9.2 million and increases with facility size. The revenue per employee is approximately $182,000 and is proportional to facility size. The revenue per employee from the Dun & Bradstreet 2017 database are comparable to that from the Economic Census when adjusted to 2017 dollars, adding to staff's confidence in the validity of the U.S. Economic Census data.[16]

https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31A1&prodType=table

[15] U.S. Census Bureau. Manufacturing Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31SG2&prodType=table

[16] The $137,200 from Table 6 is approximately $151,000 in 2017 dollars when adjusted for California CPI.

Table 7:
Summary of Dun & Bradstreet Revenue and Employment Data (2017) by Facility Size

Employees	Number of facilities	Total Revenue (Millions)	Total Employees	Average Revenue (Millions)	Revenue per Employee
1 to 4	11	$1.90	25	$0.17	$76,000
5 to 9	14	$7.59	85	$0.54	$89,000
10 to 19	19	$24.18	246	$1.27	$98,000
20 to 49	24	$97.98	792	$4.08	$124,000
50 to 99	20	$233.52	1318	$11.68	$177,000
100 to 249	14	$498.97	2080	$35.64	$240,000
250 to 499	2	$97.32	743	$48.66	$131,000
Overall	**104**	**$961.46**	**5289**	**$9.24**	**$182,000**

The Dun & Bradstreet data are also summarized by facility classification in Table 8. These classifications correspond with those presented in the cost analysis section (Table 3). The Anodizing (Medium) facilities tend to have higher revenues than corresponding decorative and hard plating shops on average. There is a large range in revenue and number of employees within the facility categories.

Table 8
Summary of Dun & Bradstreet Revenue and Employment Data (2017) by Facility Category

Category*	Number of Facilities	Average Annual Revenue (Millions)	Range of Annual Revenue (Millions)	Average Number of Employees per facility	Range of Employees per facility	Average Revenue per employee
Anodizing (Medium)	14	$25.71	$1.1 - $167.92	109	40 - 388	$240,000
Anodizing (Small)	13	$13.44	$0.35 - $56.22	61	7 - 154	$220,000
Decorative (Large)	5	$10.76	$0.16 - $24.04	77	2 - 150	$140,000
Decorative (Medium)	11	$10.19	$0.04 - $58.81	62	1 - 225	$160,000
Decorative (Other)	2	$1.56	$0.05 - $3.06	8	1 - 14	$210,000
Decorative (Small)	27	$1.67	$0.08 - $5.8	18	1 - 70	$90,000
Hard (Large)	18	$5.10	$0.22 - $45.85	40	3 - 355	$130,000
Hard (Medium)	4	$10.09	$0.59 - $19.93	54	5 - 130	$190,000
Hard (Small)	6	$8.20	$0.86 - $42.49	42	7 - 175	$200,000
Trivalent (Other)	4	$7.85	$0.72 - $20.35	53	7 - 140	$150,000
Total	**104**	**$9.24**	**$0.04 - $167.92**	**51**	**1 - 388**	**$180,000**

*Anodizing (Other) and multiple (Large) are excluded from the table due to lack of revenue data. Hard (Other) was combined with Hard (Large) category because Hard (other) consists of one facility.

During the development of PAR 1469, facilities were sent a survey with questions on many aspects of their operations. Included were questions on the number of workers employed by facility and the average annual revenues. The response rate to the questions on number of employees was about 45% and the response rate to the questions on revenue was about 36%. Staff's analysis of this survey data resulted in an average revenue per employee of about $69,000. Upon statistical evaluation it was found that these data differ significantly from the baseline data from the U.S. Economic Census and facility specific data provided by the Dun & Bradstreet database.[17] Due to this large difference, the survey data was not utilized here for the assessment of facility-based impacts.

- **Analysis**

Table 9 summarizes the results of the analysis using the Dun & Bradstreet sales data. The second column shows the average annual facility cost for facilities in each category for the both the high and low cost scenarios. The Anodizing (Medium facility) category has the highest average cost for both the high and low cost scenario, with a range of $55,000 to $90,000. The facility average cost for the Decorative (Small) category, which has the greatest number of affected facilities, ranges from $12,000 to $26,000. The next column shows the range of facility costs in each category. Facility costs are estimated to range from $0 to $97,000 depending on facility category and low or high cost scenarios. The Anodizing (Medium) category has costs that range from $5,000 to $97,000, while the Decorative (Small) category has costs that range from $12,000 to $26,000.

Table 9
Facility-specific Annual Cost and Cost Impacts

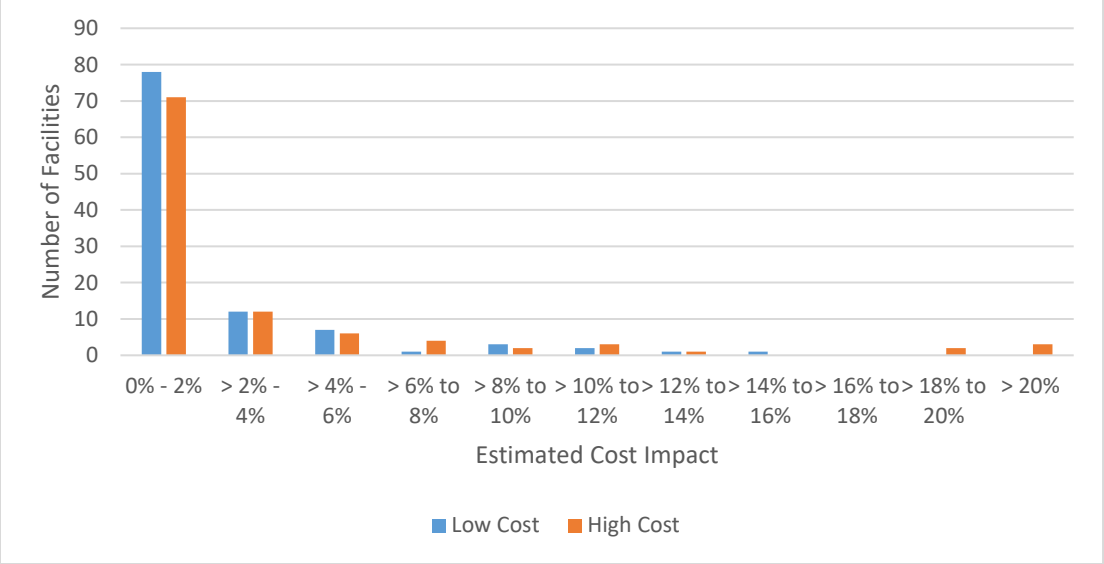
Category	Average Facility Annual Cost (Low Cost Scenario - High Cost scenario)	Range of Facility Annual Cost (Min - Max)	Average Cost Impacts (Low Cost scenario - High Cost Scenario)
Anodizing (Medium)	$55,000 - $90,000	$5,000 - $97,000	0.8% - 1.4%
Anodizing (Small)	$44,000 - $65,000	$43,000 - $66,000	1.6% - 2.5%
Decorative (Large)	$3,000 - $3,000	$3,000 - $3,000	0.4% - 0.4%
Decorative (Medium)	$16,000 - $24,000	$16,000 - $24,000	1.6% - 2.4%
Decorative (Other)	$3,000 - $3,000	$3,000 - $3,000	3% - 3.1%
Decorative (Small)	$12,000 - $26,000	$12,000 - $26,000	3.4% - 7.4%
Hard (Large)	$22,000 - $30,000	$22,000 - $30,000	1.9% - 2.7%
Hard (Medium)	$7,000 - $7,000	$6,000 - $9,000	0.4% - 0.4%
Hard (Small)	$2,000 - $4,000	$1,000 - $4,000	0.1% - 0.3%
Trivalent (Other)	$0 - $0	$0 - $0	0% - 0%
Total	**$22,000 - $36,000**	**$0 - $97,000**	**1.8% - 3.3%**

[17] A student's t-test was used to test the hypothesis that the sample average revenue per employee was different from that of the Economic Census. The result of the test was to reject the null hypothesis that the two averages were equal with $\alpha < 0.01$.

Combining these cost data with the revenue data from Table 7, the facility based cost impacts are estimated. The cost impacts for affected facilities are on average 1.8% for the low cost scenario and 3.3% for the high cost scenario. The Anodizing (Medium) category has average cost impacts that range from 0.8% to 1.4%, while the Decorative (Small) category has average cost impacts that range from 3.4% to 7.4%.

These facility-specific cost impacts are provided here for additional information, as requested by stakeholders, as SCAQMD does not have any threshold above which cost impacts are considered significant. Figure 2 illustrates the distribution of cost impacts for affected facilities. It is important to note that there greater amount of uncertainty associated with the estimate for any individual facility than there is for the average impact shown in Table 9. Figure 2 below illustrates the predominance of facilities in both scenarios that are estimated to have cost impacts of 0% to 2%.

Figure 2:
Distribution of Cost Impacts



While the facility-based analysis provides further information about the cost impacts to individual facilities, it cannot provide information about how these costs may be passed through to downstream industries and other end-users. It is likely that if a large portion of facilities in this industry are incurring compliance costs, it will have an effect on prices throughout the supply-chain. The extent to which these cost are passed through and have impacts on the regional economy is discussed in the next section of this report.

Many of these facilities would be impacted by PAR 1469 if chemical fume suppressants are not re-certified and are required to install add-on pollution controls. Recognizing this potential financial impact to these smaller facilities, the adoption Resolution for PAR 1469 will include a commitment that staff will seek funding to help offset the cost of add-on pollution controls if non-PFOS chemical fume suppressants cannot be recertified.

JOBS AND OTHER SOCIOECONOMIC IMPACTS

The REMI model (PI+ v2.1) was used to assess the total socioeconomic impacts of a policy change (i.e., the proposed amended rule). The model links the economic activities in the counties of Los Angeles, Orange, Riverside, and San Bernardino, and for each county, it is comprised of five interrelated blocks: (1) output and demand, (2) labor and capital, (3) population and labor force, (4) wages, prices and costs, and (5) market shares.[18]

The analysis is performed relative to a baseline ("business as usual") where PAR 1469 would not be implemented. PAR 1469 would create a policy scenario under which the affected facilities would incur an average annual compliance cost totaling $2.65 to $4.26 million to comply with proposed requirements. Direct effects of PAR 1469 have to be estimated and used as inputs to the REMI model in order for the model to assess secondary and induced impacts for all the actors in the four-county economy on an annual basis and across a user-defined horizon (2019 to 2035). Direct effects of PAR 1469 include additional costs to the affected entities and additional sales by local vendors of equipment, devices, or services that would meet the proposed requirements. While compliance expenditures may increase the cost of doing business for affected facilities, the purchase of additional APCs and HEPA filters combined with spending on operating and maintenance, and source tests, may increase sales in other sectors. Table 10 lists the industry sectors modeled in REMI that would either incur costs or benefits from the compliance expenditures.[19]

[18] Within each county, producers are made up of 66 private non-farm industries, three government sectors, and a farm sector. Trade flows are captured between sectors as well as across the four counties and the rest of U.S. Market shares of industries are dependent upon their product prices, access to production inputs, and local infrastructure. The demographic/migration component has 160 ages/gender/race/ethnicity cohorts and captures population changes in births, deaths, and migration. (For details, please refer to REMI online documentation at http://www.remi.com/products/pi.)

[19] Improved public health due to reduced air pollution emissions may also result in a positive effect on worker productivity and other economic factors; however, public health benefit assessment requires the modeling of air quality improvements. Therefore, it is conducted for Air Quality Management Plans and not for individual rules or rule amendments.

Table 10:
Industries Incurring *vs.* Benefitting from Compliance Costs/Spending

Source of Compliance Costs	REMI Industries Incurring Compliance Costs (3-digit NAICS)	REMI Industries Benefitting from Compliance Spending (NAICS)
APCs (HEPA Filters)	Fabricated Metal Manufacturing (332) Other Manufacturing (333-337) Wholesale and Retail Trade (423, 444) Professional, Scientific, and other Technical Services (541, 651) Repair and Maintenance (811)	*One-time-Capital:* Machinery Manufacturing (333)
APCs (HEPA) Maintenance		*Recurring Cost:* Professional, Scientific, and Technical Services (541)
Initial Source Tests		*One-time Cost* Professional, Scientific, and Technical Services (541)
Recurring Screening Tests		*Recurring Cost* Professional, Scientific, and Technical Services (541)
Permanent Total Enclosures		
Building Enclosure Modifications		*One-time-Capital:* Construction (236)
BMPS BMPs (Splash Guards, Barrier, Pressure Gauge, Magnetic Control Device)		*One-time-Capital:* Machinery Manufacturing (333)
Utilities (Electricity)		*Recurring Cost:* Utilities (221)
Permits for New APCs		*One-time-Capital:* Government (92)
Annual Permit Renewal Fee Permits		*Recurring Cost:* Public Administration (92)[20]
Fluid Eductors		*One-time-Capital:* Machinery Manufacturing (333)

As discussed earlier, the total average (2019 to 2035) annual compliance costs for affected facilities from PAR 1469 was estimated to range from $2.65 million (low cost scenario) to $4.26 million (high cost scenario) per year.

[20] Instead of using the default "local government spending" policy variable in REMI, staff elected to use a "custom local government spending" policy variable that it considers to more accurately reflect the SCAQMD spending portfolio. This custom policy variable has a lower proportion of local government spending going into the construction industry and proportionately allocates the difference to local government and professional services sectors. The simulation using this custom policy variable results in a prediction of a lower net job gain than would have been found with the default policy variable. This follows the approach taken in the Socioeconomic Assessment of the Proposed Amended Regulation III Fees from June 2017.

As presented in Tables 11 and 12, PAR 1469 is expected to result in approximately 37 to 63 to jobs forgone annually, on average between 2019 and 2035, when a low cost scenario and high cost scenario are assumed. The projected jobs loss impacts represent about 0.001 % of the total employment in the four-county region. In 2019, under both scenarios, a few additional jobs could be created in the overall economy. Job gains in the sector of manufacturing (NAICS 31-33) are due to purchase of various types of control equipment by the affected facilities (as presented in Tables 11 and 12).

The manufacturing sector (NAICS 31-33), which is projected to bear most of the estimated total compliance costs would have about 2 to 12 jobs forgone on average annually. The remainder of the projected reduction in employment would be across all major sectors of the economy from secondary and induced impacts of PAR 1469, such as the additional costs of doing business by the affected supply-chain businesses.

Although the manufacturing sector would bear the majority of the estimated total compliance costs of PAR 1469, the industry job impact is projected to be relatively small (annual average of 2 to 12 jobs foregone between 2019 and 2035). This is because other businesses in the manufacturing sector, specifically in the machinery manufacturing industry, are expected to benefit from the increased sale of various types of control equipment, thus offsetting the direct effect of compliance costs incurred by other manufacturing facilities. In earlier years, job gains from the expenditures made by the affected facilities would more than offset the jobs forgone from the additional cost of doing business. Jobs foregone in the later years are due to the additional cost of doing business by affected facilities.

Table 11:
Job Impacts of PAR 1469 (High Cost Scenario)

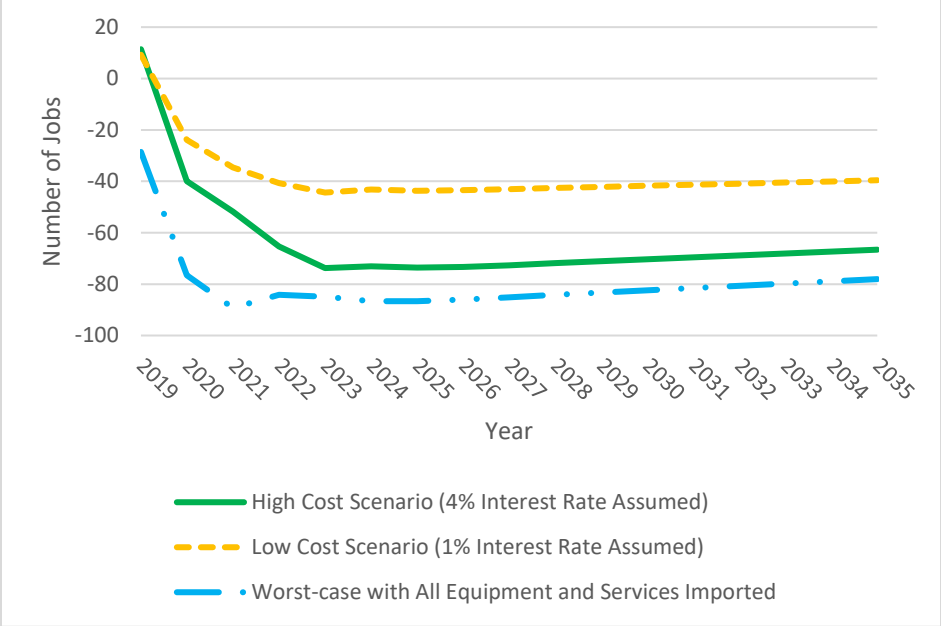
Industries (NAICS)	2019	2025	2035	Average Annual Jobs (2019-2035)	Average Annual Baseline Jobs (2019-2035)	% Change from Baseline Jobs
Construction (23)	-1	-10	-4	-7	535,349	-0.001%
Fabricated Metal (332)	0	-7	-8	-7	91,762	-0.007%
Machinery (333)	8	1	0	1	25,554	0.005%
Computer and Electronic Products (334)	0	-2	-2	-2	101,425	-0.002%
Rest of Manufacturing (31-33)	1	5	0	3	384,406	0.001%
Total Manufacturing (31-33)	8	-13	-14	-12	603,147	-0.002%
Wholesale trade (42)	1	-3	-3	-3	539,304	-0.001%
Retail trade (44-45)	-2	-9	-8	-8	1,039,963	-0.001%
Professional and Technical Services (54)	1	-2	-2	-1	923,211	0.000%
Food services and drinking places (722)	0	-4	-4	-4	708,842	-0.001%
Repair and Maintenance (811)	0	-1	-1	-1	129,259	-0.001%
Government (92)	3	-4	-5	-3	943,724	-0.001%
Other Industries	1	-27	-25	-24	5,759,046	-0.001%
Total	**11**	**-74**	**-67**	**-63**	**11,181,845**	**-0.001%**

Table 12:
Job Impacts of PAR 1469 (Low Cost Scenario)

Industries (NAICS)	2019	2025	2035	Average Annual Jobs (2019-2035)	Average Annual Baseline Jobs (2019-2035)	% Change from Baseline Jobs
Construction (23)	0	-6	-2	-4	535,349	-0.001%
Fabricated Metal (332)	0	-4	-5	0	91,762	0.000%
Machinery (333)	6	0	0	0	25,554	0.000%
Computer and Electronic Products (334)	0	-1	-1	0	101,425	0.000%
Rest of Manufacturing (31-33)	1	-3	-2	-2	384,406	-0.001%
Total Manufacturing (31-33)	6	-8	-9	-2	603,147	-0.001%
Wholesale trade (42)	0	-2	-2	-2	539,304	-0.001%
Retail trade (44-45)	-1	-5	-5	-5	1,039,963	-0.001%
Professional and Technical Services (54)	1	-1	-1	0	923,211	0.000%
Food services and drinking places (722)	0	-3	-3	-2	708,842	-0.001%
Repair and Maintenance (811)	0	-1	-1	-1	129,259	-0.001%
Government (92)	2	-2	-3	-2	943,724	-0.001%
Other Industries	1	-12	-10	-19	5,759,046	-0.001%
Total	**9**	**-44**	**-40**	**-37**	**11,181,845**	**0.000%**

Figure 3 presents a trend of job gain and losses over the 2019 to 2035 time frame. In addition, staff has analyzed an alternative scenario (worst case) where the affected facilities would not purchase any control or service from providers within SCAQMD's jurisdiction. This scenario would result in an average of 80 jobs forgone annually.

Figure 3:
Projected Regional Job Impact, 2019-2035



Competitiveness

PAR 1469 would increase the cost of services rendered by the affected industries in the region. The magnitude of the impact depends on the size and diversification of, and infrastructure in a local economy as well as interactions among industries. A large, diversified, and resourceful economy would absorb the impact described above with relative ease.

Changes in production/service costs would affect prices of goods produced locally. The relative delivered price of a good is based on its production cost and the transportation cost of delivering the good to where it is consumed or used. The average price of a good at the place of use reflects prices of the good produced locally and imported elsewhere.

It is projected that the manufacturing sector, where most of the affected facilities belong, would experience a rise in its relative cost of services by 0.0013% and 0.0022% and a rise in its delivered price by 0.0008% and 0.0012% in 2025 for the low and high cost scenarios, respectively.

While these changes are relatively small, it should be noted that the delivered price change is a change in the index of all prices in the manufacturing sector. Delivered prices that a facility may charge for specific goods or services may increase at a greater rate than this, allowing incurred costs to be passed through to downstream industries and end-users.